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Sweep purge versus evacuation

(Excerpt from May 4, 2010 e-mail exchange, slightly edited)

Intuitively, sweep purges/dilutions to get the majority of the contamination out makes sense to me. You would do it until you get the remaining contamination down comparable to the supplier liquid argon purity. If the vendor's liquid is good to a few ppm, then purging or diluting with 20 volume changes of vaporized argon ($290K) gets you to the ppm range. See attached spreadsheet. Then you fill with liquid and freeze out things and run your operational purifier plant.

The $290K in purge gas is cheaper than the cost of running a purification plant (to clean up liquid argon that is put in without any purges/dilutions).

If you look at evacuating a modular cryostat, the final purity before filling with liquid is limited to the purity of the gas you are backfilling with. So after two or three evacuations, you stop with a few ppm similar to the dilution/purge situation. It costs you $58K in argon for the first two backfills. You also have the equipment cost of huge vacuum pumps.

I wanted to add another thought about the difference in evacuation versus purging. I don't think that the sweep purge method would be as effective as evacuation for removing water or solvents that are adsorbed in G-10 or inside wire cable insulation, etc. Warming the argon will help. But the argument supplied by Hans for that not being an issue is that the contamination gets frozen/locked in once it is in liquid argon. If it does get out, it is removed with the molecular sieve/charcoal filter portion of the purification train.

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